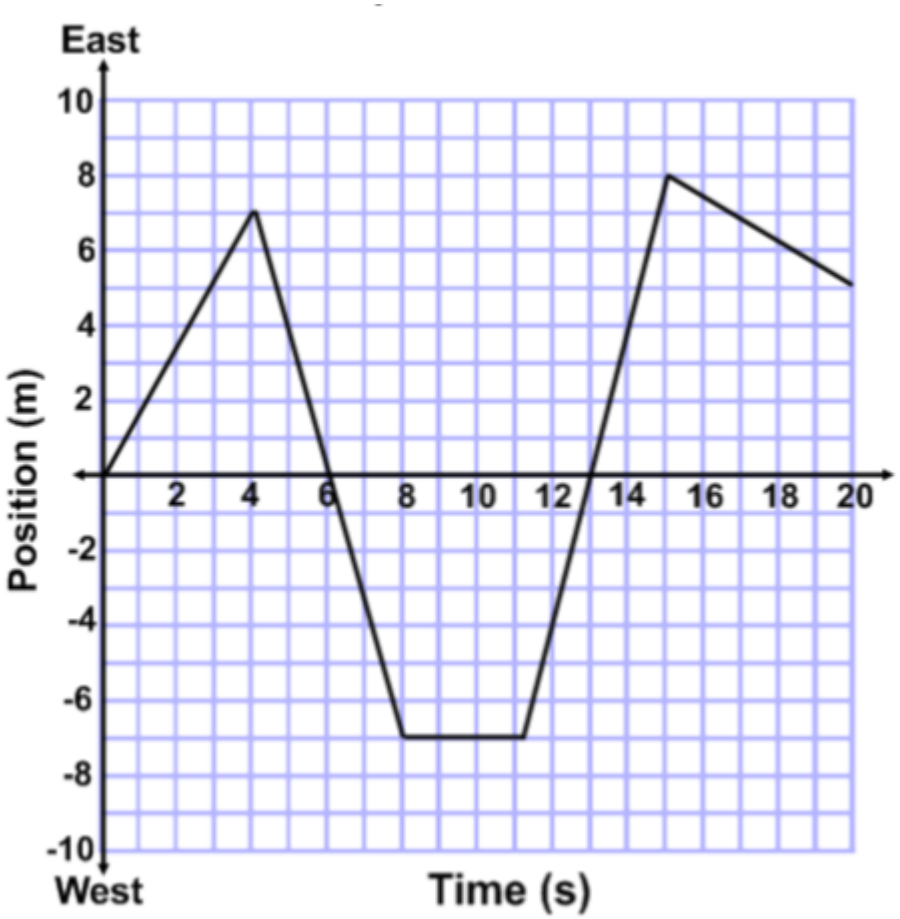
1. Describe what is meant by frame of reference and why it is important.

2. Define scalars and vectors. Provide three examples of each.

3. Calculate the average velocity and speed of the planet Saturn the instant it has traveled half of its circular orbit.

4. A football is thrown 35 m [W], 60 m [E], 12 m [E], 45 m [W] and finally 75 m [W]. All of this happens in 62 seconds. Calculate the average speed and velocity of the football.

5. Use the Graph below to answer the following questions:



a. Calculate the velocity between 4 & 6 seconds.

b. At what time(s) was the object back at the starting position?

c. At what time(s) did the object change direction?

d. Calculate the total distance traveled during the 20 seconds.

e. Calculate the average speed and velocity for the 20 seconds.

1. Define acceleration. How do the units reflect this definition?

2. Describe a situation where an object can have:
   a. A constant speed but be experiencing a non-zero acceleration.

   b. An instantaneous velocity of zero but be accelerating.

3. A car accelerates from 25 m/s [E] to 5 m/s [W] in 35 seconds.
   a. Calculate the acceleration of the car. { $\vec{a}$ = –0.86 m/s^2}

   b. Calculate the displacement of the car during the above acceleration. {$\vec{d}_f$ = 348 m}

4. A person is standing atop a cliff that is 125 m high and drops a rock to the water below.
   a. Calculate the time it takes for the rock to hit the water below. {t = 5.04 s}

   b. Calculate the velocity as it enters the water. {$\vec{v}_f$ = –49.5 m/s}

   c. Calculate the velocity of the rock 65 m above the water. {$\vec{v}_f$ = –24.3 m/s}

5. Standing on the ground a person throws a ball. It leaves his hand with an upward velocity of 17 m/s.
   a. Calculate the length of time the ball will be traveling upwards. {t = 1.73 s}

   b. Calculate the ball's maximum height. {$\vec{d}_f$ = 14.7 m}

   c. Calculate the velocity of the ball when it is 5 m above the ground. {$\vec{v}_f = \pm$ 13.8 m/s}

   d. Calculate the position above the ground when the ball traveling at 4.5 m/s upwards. {$\vec{d}_f$ = 13.7 m}

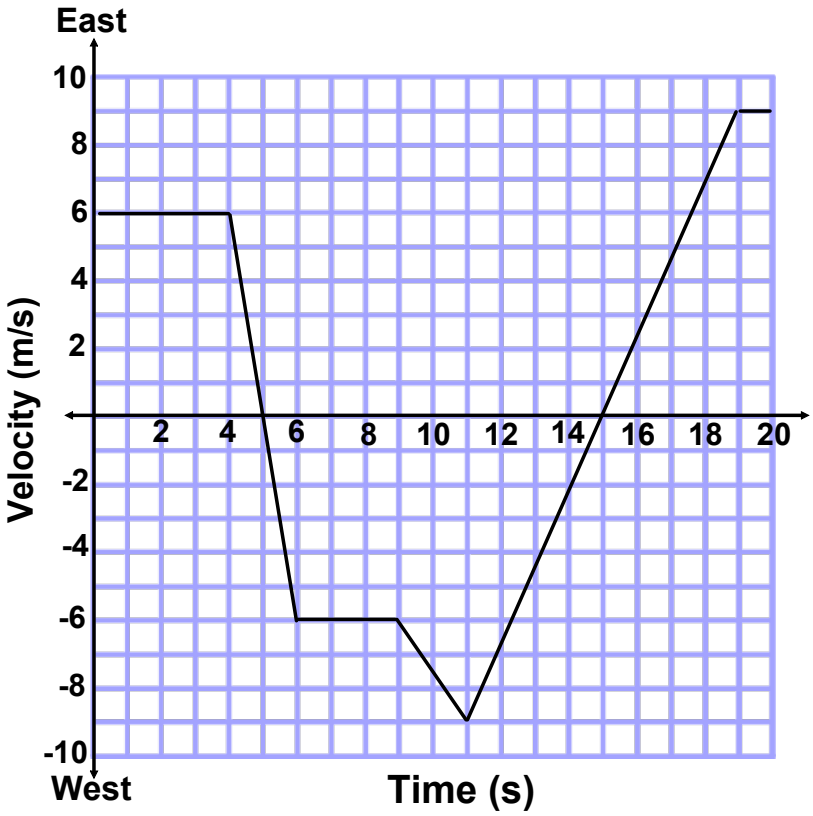
6. A plane changed its velocity from 150 m/s [S] to 415 m/s [N]. The acceleration was a constant 15.0 m/s^2.
   a. Calculate the time it took for the plane to change its velocity. {t = 37.7 s}

   b. Calculate the time it took for the plane to return to its starting point. {t = 4.47 s}

   c. Calculate the displacement of the plane in that time. {$\vec{d}_f$ = 5000 m}

   d. Calculate the distance the plane traveled in that time. {d = 6500 m}

Velocity - Time: Course Review #2



1. What is the instantaneous velocity at the 11 second mark?

2. At what time(s) did the object change direction?

3. Calculate the distance traveled during the first 5 seconds. (27 m)

4. During what time interval(s) was the acceleration opposite the direction of motion?

5. Calculate the distance traveled between 11 and 19 seconds. (45 m)

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6. Calculate the acceleration at 4.5, 8 and 13.5 seconds. (-6 m/s^2; 0 m/s^2; 2.25 m/s^2)

7. Calculate the total distance traveled during the 20 seconds. (111 m)

8. Calculate the position of the object at the 20 second mark. (-3 m)

9. Calculate the average speed and velocity for the full 20 seconds. (5.6 m/s; -0.15 m/s)

10. Assume the object started at position (0,0). Without extensive calculations, estimate at what point in time the object had instantaneously returned to its starting position. (~ 10s)

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1. Define inertia. Give an example for an object being in motion and at rest.

2. Calculate the force of gravity on a 47 kg object located on the Earth, Moon, and Mars. (461 N, 77 N, and 175 N)

3. Summarize what physical process causes the force of friction.

4. Suppose a box requires 100 N of force to begin to move. You start by applying 50 N of force and slowly increase that force until the box moves at a constant velocity.
    a. Describe the forces of friction that are involved.

    b. Would the minimum force necessary to keep the box moving at a constant velocity be less than, equal to, or greater than 100 N? Provide a brief explanation to your answer.

5. A 30 kg box is moved with a net force of 17 N. The applied force necessary is 105 N.
    a. What is the force of friction? (-88 N)

    b. . What is the normal force? (294 N)

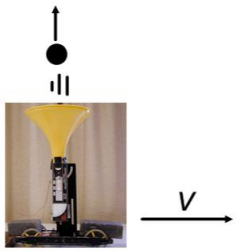
    c. What is the coefficient of kinetic friction? (0.30)

6. A 52 kg object is being pulled with an applied force of 217 N. The coefficient of kinetic friction is 0.12. Calculate the net force acting on the object? (156 N)

7. A 65 kg person is pressed up against the wall using an applied force of 1500 N. For the person not to fall, calculate the minimum coefficient of static friction necessary between the wall and the person. (0.43)

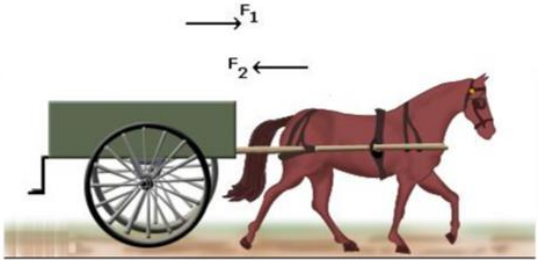
1. What is an inertial and non-inertial frame of reference? Give an example of each and be sure to clearly indicate what the frame of reference is.

2. Is the ball in the image below likely to land in the funnel if the cart is maintaining a constant velocity? What about if the cart has a constant acceleration? Provide an explanation for your answers.



3. Using Newton's 3rd law describe how the floor pushes you forward and that you do not push the floor.

4. Considering Newton's 3rd Law, how is the horse able to move the cart?



5. A 3.5 kg ball is accelerated from rest to a velocity of 18 m/s over a distance of 10 m. What force is exerted on the ball during this time? (F = 57 N)

6. An applied force of 35 N is needed to accelerate a 12 kg wagon at 1.5 m/s^2 along a sidewalk.
    a. How large is the frictional force? ($|F_f| = 17$ N)

    b. What is the coefficient of friction? ($\mu = 0.14$)

7. An elevator with a mass of 750 kg is accelerated upward at 2.4 m/s^2. What force does the cable apply to give this acceleration? ($F_a = 9160$ N)

8. A high jumper falling at a 7.5 m/s lands on foam pit and comes to rest compressing the pit 0.60 m. If the pit is able to exert an average force of 1700 N on the high jumper breaking the fall, what is the jumper's mass? (m = 36 kg)

10. A 45 kg diver steps off a 13 m high platform (initial velocity is zero). The swimmer comes to a stop 2.8 m below the surface of the water. Calculate the net stopping force exerted by the water. (F = 2050 N)